

NATIONAL BUREAU OF STANDARDS REPORT

8155

Interlaboratory Intercomparisons of 60-Watt Incandescent Lamps

by
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Photometry and Colorimetry Section
Metrology Division



U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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Interlaboratory Intercomparison
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60-Watt Incandescent Lamps

Abstract

A group of eleven 60-watt incandescent lamps were measured by each of nine laboratories. The voltage across each lamp was held at 115.0 volts while the luminous flux and current were measured. The results of the measurements made by the individual laboratories and an analysis of the results are given in this report.

I. Introduction

This intercomparison was undertaken to determine the uniformity of measurements on 60-watt incandescent lamps made at the participating laboratories. The laboratories participating and the order of reading are as follows:

1. National Bureau of Standards
2. Electrical Testing Laboratories
3. Duro Test
4. Westinghouse
5. Champion
6. Sylvania
7. El Tronics
8. General Electric
9. Verd-A-Ray

El Tronics measured the lamps twice and the values reported here are the averages of the two values they reported for each quantity. The National Bureau of Standards measured the lamps before and after the other laboratories measured them. There was no significant difference between the two sets of measurements. This indicates there was no significant change in the lamps during the measurements. The values reported here for the National Bureau of Standards are the averages of the two sets of measurements.

Each laboratory followed its own customary procedure in making the measurements. In each laboratory the lamp voltage was held constant at 115.0 volts while the luminous flux and current were measured.

II. Results of Measurements

The results reported are given in Tables 1 through 6. The averages reported for each lamp and for each laboratory are also given. The difference, Δ , between the average for each laboratory and the average for all laboratories for all the lamps is also given in the tables.

III. Analysis of the Results

An analysis of the results of the measurements has been made following a modification of the method described by W. J. Youden (1), (2) and (3). The modification is described in National Bureau of Standards Report No. 6605, Interlaboratory Intercomparisons of 32-watt T12 Cool-White Circline Lamps, and Report No. 6698, Interlaboratory Intercomparisons of 40-watt T12 Cool-White Fluorescent Lamps. The analysis is shown on the following graphs. The point representing the measurements of an individual laboratory is designated by the first or first and second letter in the name of the laboratory. The point representing the average of all laboratories is designated by the letter A.

(1) Graphical Diagnosis of Interlaboratory Test Results, Industrial Quality Control, Vol. XV, No. 11, May 1959.

(2) Product Specifications and Test Procedures, Industrial and Engineering Chemistry, Vol. 50 page 914, October 1958.

(3) Circumstances Alter Cases, Industrial and Engineering Chemistry, Vol. 50 page 77A, December 1958.

Table 1.

Luminous Flux in Lumens

| Lamp No. | NBS | ETL | Duro T | West | Syl | El Tronics | GE | Verd-A-R | Champ | Ave |
|----------|-------|-------|--------|-------|-------|------------|-------|----------|-------|-------|
| BS8337 | 772 | 763 | 775 | 773 | 778 | 776.0 | 773 | 785 | 766 | 773.4 |
| 8340 | 741 | 740 | 744 | 740 | 760 | 744.9 | 738 | 745 | 739 | 743.5 |
| 8341 | 795 | 787 | 731 | 797 | 795 | 798.9 | 796 | 804 | 788 | 788.0 |
| 8344 | 774 | 765 | 775 | 775 | 778 | 777.1 | 772 | 789 | 765 | 774.5 |
| 8345 | 771 | 764 | 775 | 772 | 779 | 774.4 | 771 | 774 | 765 | 771.7 |
| 8346 | 770 | 765 | 774 | 771 | 777 | 772.8 | 770 | 779 | 767 | 771.8 |
| 8347 | 776 | 774 | 780 | 780 | 782 | 779.4 | 776 | 782 | 772 | 777.9 |
| 8348 | 758 | 755 | 764 | 758 | 764 | 761.1 | 758 | 772 | 754 | 760.5 |
| BS6557 | 760 | 755 | 763 | 758 | 764 | 761.6 | 762 | 761 | 754 | 759.8 |
| 6558 | 778 | 777 | 783 | 776 | 782 | 777.8 | 776 | 780 | 773 | 778.1 |
| 6559 | 728 | 721 | 731 | 728 | 732 | 731.4 | 725 | 732 | 725 | 728.2 |
| | 765.7 | 760.5 | 763.2 | 766.2 | 771.9 | 768.7 | 765.2 | 773.0 | 760.7 | 766.1 |
| Δ | -.4 | -5.6 | -2.9 | +.1 | +5.8 | +2.6 | -.9 | +6.9 | -5.4 | ; |
| %Δ | .05 | .73 | .38 | .01 | .76 | .34 | .12 | .90 | .70 | |

Table 2.

Current in Amperes

| Lamp No. | NBS | ETL | Duro T | West | Syl | El Tronics | GE | Verd-A-R | Champ | Ave |
|----------|-------|--------|--------|--------|--------|------------|--------|----------|--------|-------|
| BS8337 | .5328 | .5330 | .532 | .5327 | .534 | .531 | .5334 | .532 | .532 | .5325 |
| 8340 | .5283 | .5292 | .528 | .5287 | .532 | .528 | .5286 | .529 | .528 | .5289 |
| 8341 | .5386 | .5370 | .538 | .5388 | .538 | .539 | .5396 | .538 | .539 | .5384 |
| 8344 | .5337 | .5336 | .533 | .5337 | .534 | .532 | .5340 | .534 | .533 | .5334 |
| 8345 | .5334 | .5332 | .533 | .5337 | .534 | .532 | .5338 | .533 | .533 | .5332 |
| 8346 | .5292 | .5294 | .528 | .5294 | .530 | .528 | .5294 | .529 | .529 | .5290 |
| 8347 | .5304 | .5302 | .530 | .5307 | .531 | .530 | .5304 | .530 | .530 | .5303 |
| 8348 | .5318 | .5318 | .532 | .5317 | .533 | .530 | .5344 | .530 | .532 | .5319 |
| BS6557 | .5286 | .5296 | .528 | .5287 | .529 | .528 | .5288 | .529 | .529 | .5287 |
| 6558 | .5318 | .5321 | .531 | .5317 | .532 | .530 | .5322 | .530 | .532 | .5314 |
| 6559 | .5240 | .5236 | .523 | .5240 | .525 | .523 | .5242 | .526 | .523 | .5240 |
| | .5311 | .5312 | .5305 | .5313 | .5320 | .5301 | .5317 | .5309 | .5309 | .5311 |
| Δ | .0000 | +.0001 | -.0006 | +.0002 | +.0009 | -.0010 | +.0006 | -.0002 | -.0002 | |
| %Δ | 0 | .02 | .11 | .04 | .17 | .19 | .11 | .04 | .04 | |

Table 3.

Lumens per Watt

| Lamp No. | NBS | ETL | Duro T | West | Syl | El Tronics | GE | Verd-A-R | Champ | Ave |
|----------|-------|-------|--------|-------|-------|------------|-------|----------|-------|-------|
| BS8337 | 12.60 | 12.45 | 12.67 | 12.62 | 12.67 | 12.70 | 12.57 | 12.83 | 12.52 | 12.63 |
| 8340 | 12.20 | 12.16 | 12.25 | 12.17 | 12.42 | 12.28 | 12.11 | 12.25 | 12.17 | 12.22 |
| 8341 | 12.84 | 12.74 | 11.82 | 12.86 | 12.85 | 12.90 | 12.80 | 12.99 | 12.71 | 12.72 |
| 8344 | 12.61 | 12.47 | 12.64 | 12.63 | 12.67 | 12.71 | 12.55 | 12.85 | 12.48 | 12.62 |
| 8345 | 12.57 | 12.46 | 12.64 | 12.58 | 12.69 | 12.66 | 12.53 | 12.63 | 12.48 | 12.58 |
| 8346 | 12.65 | 12.57 | 12.25 | 12.66 | 12.75 | 12.72 | 12.61 | 12.81 | 12.61 | 12.63 |
| 8347 | 12.72 | 12.69 | 12.80 | 12.78 | 12.81 | 12.80 | 12.69 | 12.83 | 12.67 | 12.75 |
| 8348 | 12.39 | 12.34 | 12.49 | 12.40 | 12.46 | 12.48 | 12.36 | 12.67 | 12.32 | 12.43 |
| NBS6557 | 12.50 | 12.40 | 12.57 | 12.47 | 12.56 | 12.53 | 12.49 | 12.51 | 12.39 | 12.49 |
| 6558 | 12.72 | 12.70 | 12.82 | 12.69 | 12.78 | 12.76 | 12.66 | 12.80 | 12.63 | 12.73 |
| 6559 | 12.08 | 11.97 | 12.15 | 12.08 | 12.12 | 12.16 | 11.99 | 12.10 | 12.06 | 12.08 |
| Ave | 12.53 | 12.45 | 12.46 | 12.54 | 12.62 | 12.61 | 12.49 | 12.66 | 12.46 | 12.54 |
| Δ | -.01 | -.09 | -.08 | -.00 | +.08 | +.07 | -.05 | +.12 | -.08 | |
| %Δ | .08 | .72 | .64 | 0 | .64 | .56 | .40 | .96 | .64 | |

Figure 1

Lumens

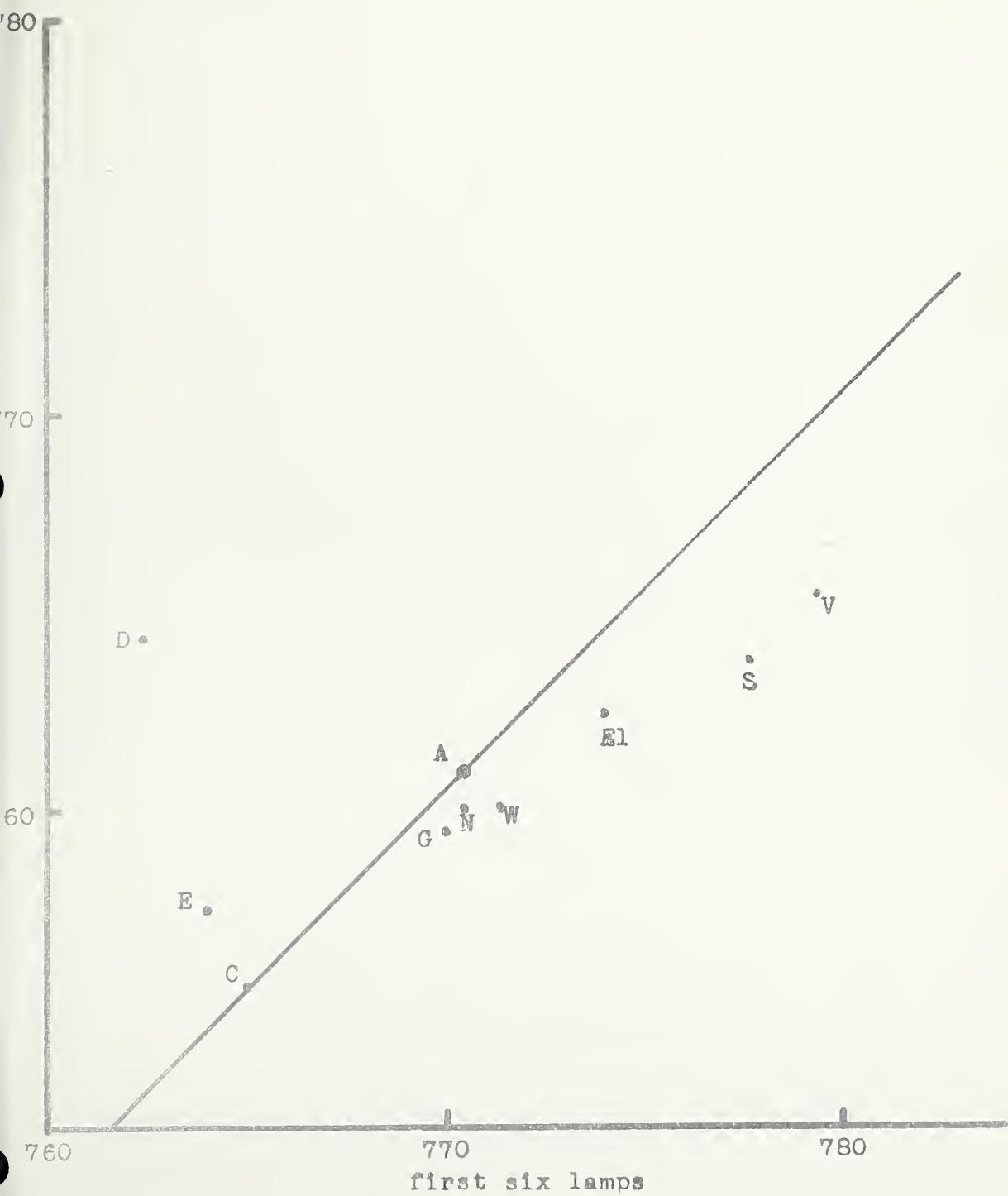


Figure 2

Amperes

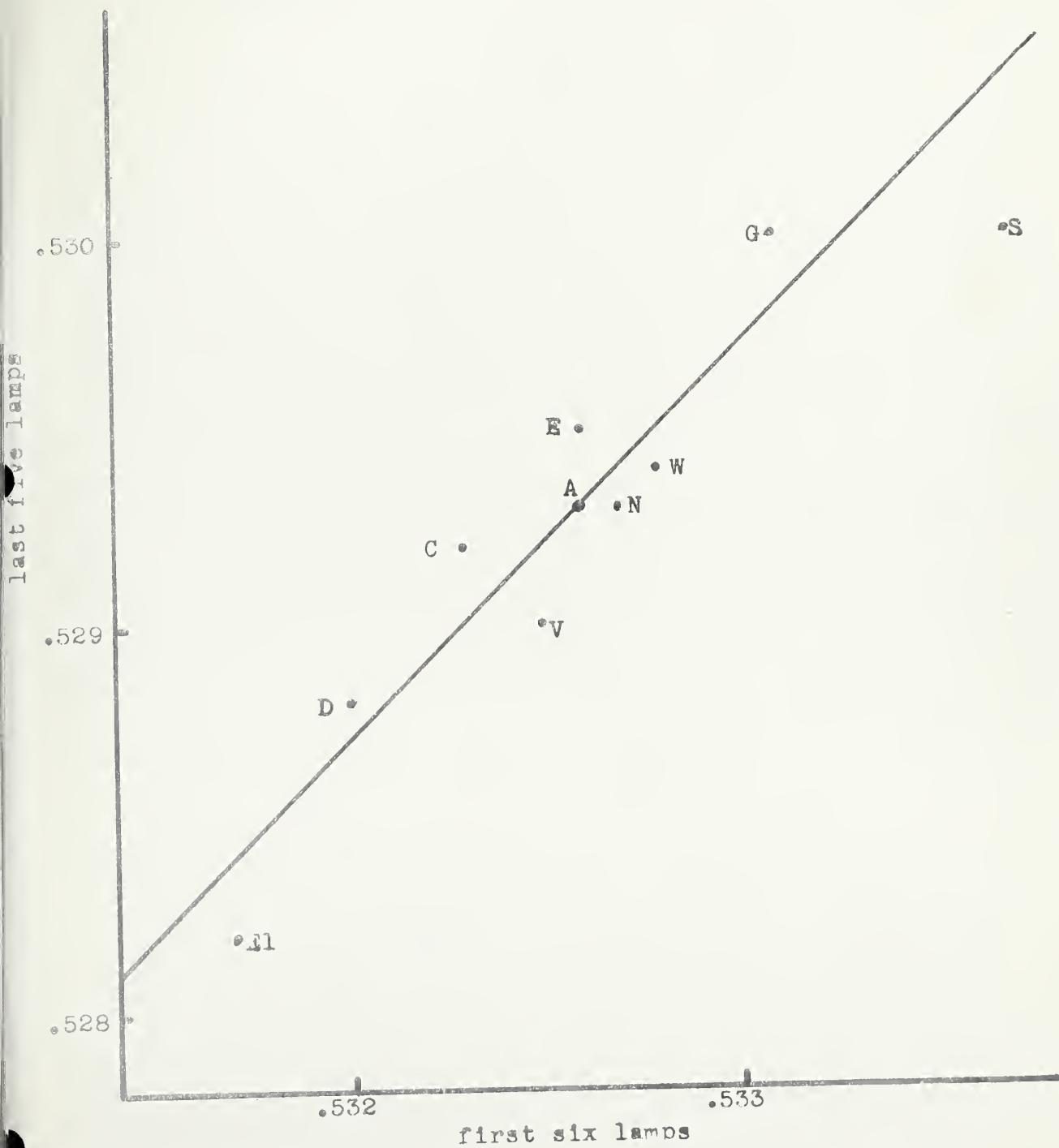
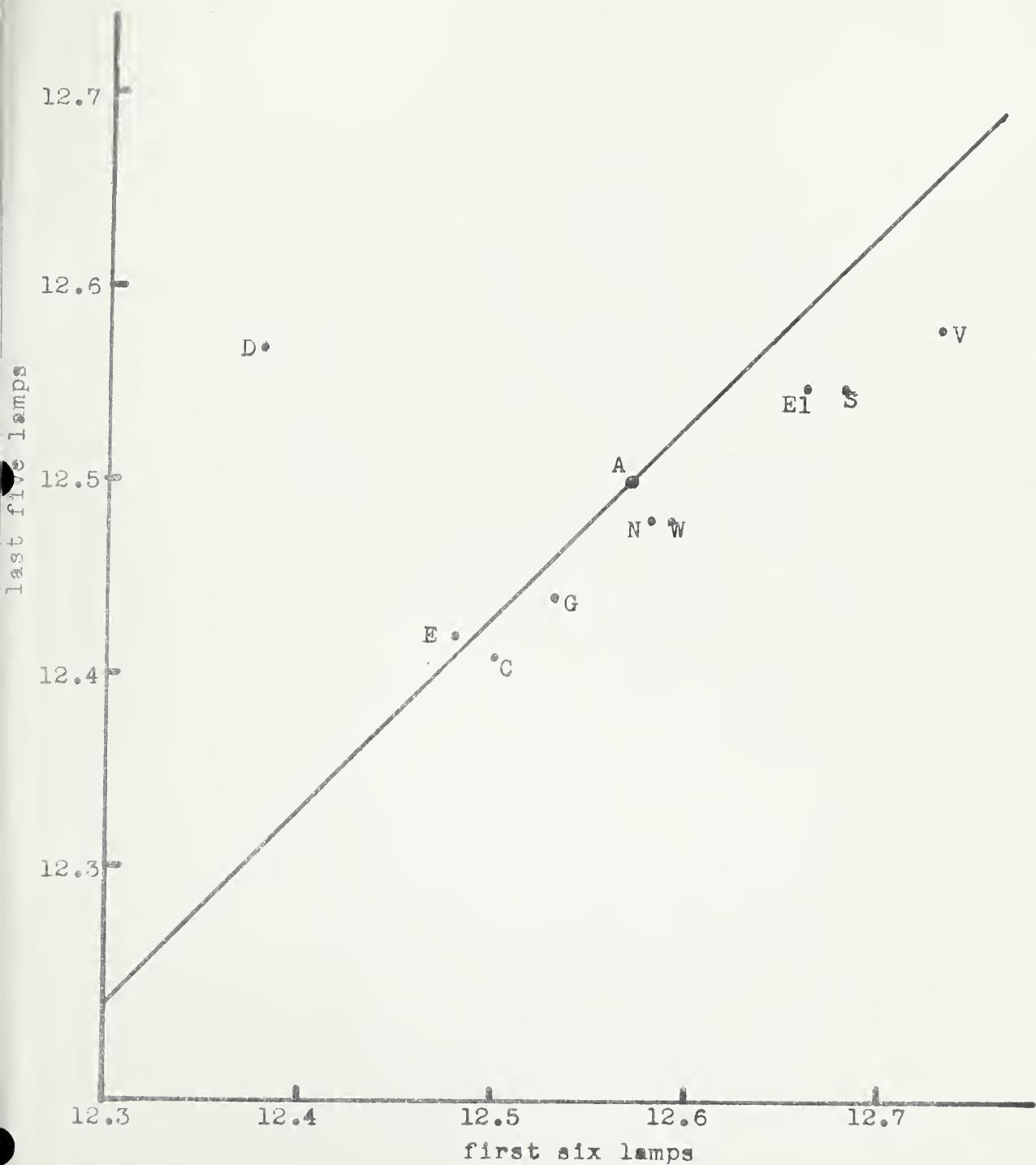


Figure 3
Lumens per Watt



THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

WASHINGTON, D. C.

Electricity. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics. High Voltage. Absolute Electrical Measurements.

Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Volume.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research. Crystal Chemistry.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Polymers. Macromolecules: Synthesis and Structure. Polymer Chemistry. Polymer Physics. Polymer Characterization. Polymer Evaluation and Testing. Applied Polymer Standards and Research. Dental Research.

Metallurgy. Engineering Metallurgy. Metal Reactions. Metal Physics. Electrolysis and Metal Deposition.

Inorganic Solids. Engineering Ceramics. Glass. Solid State Chemistry. Crystal Growth. Physical Properties. Crystallography.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials. Metallic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

Data Processing Systems. Components and Techniques. Computer Technology. Measurements Automation. Engineering Applications. Systems Analysis.

Atomic Physics. Spectroscopy. Infrared Spectroscopy. Far Ultraviolet Physics. Solid State Physics. Electron Physics. Atomic Physics. Plasma Spectroscopy.

Instrumentation. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Physical Chemistry. Thermochemistry. Surface Chemistry. Organic Chemistry. Molecular Spectroscopy. Elementary Processes. Mass Spectrometry. Photochemistry and Radiation Chemistry.

Office of Weights and Measures.

BOULDER, COLO.

CRYOGENIC ENGINEERING LABORATORY

Cryogenic Processes. Cryogenic Properties of Solids. Cryogenic Technical Services. Properties of Cryogenic Fluids.

CENTRAL RADIO PROPAGATION LABORATORY

Ionosphere Research and Propagation. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services. Vertical Soundings Research.

Troposphere and Space Telecommunications. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Spectrum Utilization Research. Radio-Meteorology. Lower Atmosphere Physics.

Radio Systems. Applied Electromagnetic Theory. High Frequency and Very High Frequency Research. Frequency Utilization. Modulation Research. Antenna Research. Radiodetermination.

Upper Atmosphere and Space Physics. Upper Atmosphere and Plasma Physics. High Latitude Ionosphere Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.

RADIO STANDARDS LABORATORY

Radio Standards Physics. Frequency and Time Disseminations. Radio and Microwave Materials. Atomic Frequency and Time-Interval Standards. Radio Plasma. Microwave Physics.

Radio Standards Engineering. High Frequency Electrical Standards. High Frequency Calibration Services. High Frequency Impedance Standards. Microwave Calibration Services. Microwave Circuit Standards. Low Frequency Calibration Services.

Joint Institute for Laboratory Astrophysics-NBS Group (Univ. of Colo.).

